What Images Show that Words Do Not: Analysis of Pre-service Teachers' Depictions of Effective Agricultural Education Teachers in the 21st Century

J. Shane Robinson
Oklahoma State University

Kathleen D. Kelsey
University of Georgia

Robert Terry, Jr.
Oklahoma State University

Abstract

One of the intended outcomes of agricultural teacher education programs is the progressive development and refinement of students' professional identity. The purpose of this study was to determine the extent to which pre-service agriculture teachers' mental models, depicting the roles and responsibilities of school-based agriculture teachers, changed over the course of a semester-long teacher education course. Pre-service teachers were asked to draw images depicting an effective agriculture teacher at three points during the semester. Those images served as a mediator for surfacing the idealized agriculture teacher and were analyzed by three researchers using a variety of methods. Four themes emerged to describe pre-service teachers' mental models of effective teaching: instruction, settings, curricular diversity, and engagement. Desired constructs, such as student engagement and curricular diversity, of the ideal agriculture teacher were noted from the beginning to the middle of the semester; however, undesirable constructs, such as teacher-directed instruction that focused on traditional topics and lacked STEM integration, emerged in the drawings from the middle to the end of the semester. It is recommended that the study be replicated over teachers' entire preparation experience to determine how their professional identity is impacted by various treatments inherent in the pre-service teacher education program.

Keywords: pre-service teacher beliefs; images of effective teaching

Teachers who are highly qualified and effective are needed desperately in school systems today (Feistritzer & Haar, 2008; Good, McCaslin, Tsang, Zhang, Wiley, Bozack, & Hester, 2006). As a result, the general perception among the American public is that the teaching profession is of low quality (Akiba, LeTendre, & Scribner, 2007).

Roberts and Dyer (2004) identified eight *effectiveness variables* for agricultural education teachers. These variables are teaching in the classroom and laboratory, advising the program's youth leadership organization – known as the FFA, monitoring students' supervised agricultural experiences (SAE), building relationships within the community, marketing the program, participating in professional development

and becoming a lifelong learner, planning the comprehensive program, and improving personal traits and qualities. In addition, a study by Jenkins III and Kitchel (2010) identified 37 quality instruction indicators that effective teachers should practice. These indicators ranged from teachers being able to identify appropriate class sizes to using student-centered teaching methods.

Although numerous attributes of effective teaching have been identified, individuals take complex situations that are multifaceted in nature and compress them "into one holistic perceptual identity" (Korthagen & Kessels, 1999, p. 9). It is important, therefore, for teacher educators to recognize how students construct the teaching and learning process in light of known

variables for effectiveness (Hofer & Pintrich, 1997). One such method is to analyze pre-service teachers' mental images of effective teaching in the form of drawings (Calderhead & Robson, 1991; Minogue, 2010; Thomas, Pederson, & Finson, 2001).

Mental images of effective teaching inform even the most novice teachers (Wideen, Mayer-Smith, & Moon, 1998). Creating mental images allows individuals to take ownership of their learning by developing their identity and level of understanding of a certain phenomenon in a way that is creative and empowering (Martin, 2008). Creating mental images are important for pre-service teachers because they allow for self-visualization of conducting and accomplishing a task effectively and successfully (Bandura, 1994; Minogue, 2010). Wubbles (1992) recognized that pre-service teachers enter teacher preparation programs with "world images" (p. 147) of effective teaching.

Analyzing pre-service teachers' mental images is one method of determining instructional impact on pre-service teachers' construction of a professional identity (Minogue, 2010). Teacher images are based on his or her feelings, former experiences, values, perceptions of the role(s) that should be played, needs and concerns of the situation, and the way they react to unplanned incidents in a classroom setting (Korthagen & Kessels, 1999).

According to Korthagen and Kessels (1999), teachers visualize effective teaching by forming *Gestalts*, or images, based on their previous experiences (see Figure 1). Once Gestalts have been established, authority figures, such as teacher educators, supervisors, and principals, can challenge teachers at the Gestalt level by helping them form schemas, "which on one hand is still tied to concrete experiences, but on the other hand becomes more detached from these experiences" (Korthagen & Kessels, 1999, p. 10).
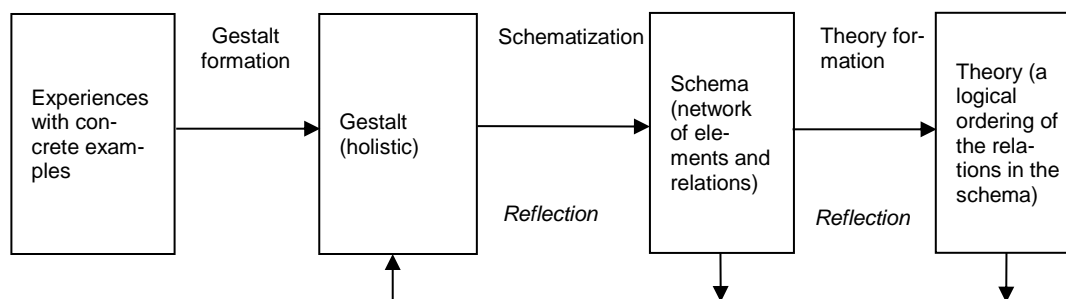

Figure 1. Korthagen's and Kessel's (1999) model of levels regarding the process of learning a certain domain.

At Oklahoma State University, pre-service agricultural education students enroll in AGED 3103 – Foundations and Philosophies of Teaching Agricultural Education as juniors. This course is designed to assist students to develop their philosophy of agricultural education and construct a personal identity as an agricultural instructor, with special emphasis on pedagogy and specific attention to lesson planning, teaching methods, and lesson delivery. No research has been conducted; however, to determine the degree to which students' identity develops or changes throughout the semester. Because this course is the first pre-service course for pre-

service teachers, it is imperative to determine how their professional identity is formed, as it will influence their behaviors as a teacher.

Regarding their views of preparing teachers for classroom instruction, Korthagen and Kessels (1999) stated,

> Teacher development is conceptualized as an ongoing process of experiencing practical teaching and learning situations, reflecting on them under the guidance of an expert, and developing one's own insights into teaching through the interaction between personal reflection

and theoretical notions offered by the expert. (p. 5)

For teacher conceptualization to occur, schemas must be created and organized based on the individual's prior knowledge (Santrock, 2004). This prior knowledge can exist as concepts, knowledge, or information about a variety of events that have occurred in the past. Schemas allow individuals to generate a broad picture of whatever event they are being asked to recollect in the form of mental models (Santrock, 2004). Therefore, the theoretical underpinnings of this study consisted of mental images and teacher beliefs, as expressed through drawings (Minogue, 2010; Thomas et al., 2001).

Mental images are generalizations about what people perceive about a particular situation or event (Johnson-Laird, 2001). They are developed through creative measures and are based on former experiences of a person (Byrne, 2002). As such, it is difficult to deconstruct a person's mental images of a situation (Byrne, 2002, Doolittle, Dodds, & Placek, 1993). For these reasons, individuals enter teacher preparation programs with strong mental models that consist of "quite powerful and influential images of teaching" (Calderhead & Robson, 1991, p. 8). Preservice teachers create mental images as a result of their beliefs about a phenomenon, such as teaching, which can be a powerful influencer on their behavior (Pajares, 1982). In fact, "beliefs influence knowledge acquisition and interpretation, task definition and selection, interpretation of course content, and comprehension monitoring (Pajares, 1982, p. 328).

Teacher beliefs are based on a teacher's memory of episodes that happened previously. Ertmer (2005) stated that, "early episodes or events, . . . have the potential to color perceptions of subsequent events, especially if early experiences are particularly unique or vivid. Further, because of their highly personal nature, beliefs are unlikely to be affected by persuasion" (p. 29). Beliefs can be changed according to three experiences: personal, vicarious, and socio-cultural (Ertmer, 2005). In general, teachers will be more apt to change their beliefs about teaching whenever they encounter a personal experience that encourages them to rethink their current strategy and consider adopting a new practice (personal), when they see others

deemed similar to themselves adopt, and have success with, new practices related to teaching (vicarious), and when their beliefs are constantly challenged through norms by those around them (socio-cultural influences). When these three strategies are employed, the opportunity to change teachers' core beliefs increases (Ertmer, 2005). Feiman-Nemser (2001) stated,

> The images and beliefs that prospective teachers bring to their preservice preparation serve as filters for making sense of the knowledge and experiences they encounter. The may also function as barriers to change by limiting the ideas that teacher education students are able and willing to entertain. (p. 1016)

Therefore, what images and beliefs do preservice teachers bring to the university setting and how do those images change as a result of teacher education coursework?

Purpose of the Study

The purpose of the study was to determine the extent to which agricultural education preservice teachers' beliefs changed as a result of their enrollment in a semester-long course titled, *Foundations and Philosophies of Agricultural Education*. The following research questions guided the study.

1. Interpret agricultural education preservice teachers' images of effective teaching
2. Determine how agricultural education pre-service teachers' images of effective teaching change over time.

Methodology

Data for this research consisted of one-page drawings created by pre-service teachers enrolled in a required teacher education class. Three times during the 16-week fall semester (beginning [August], middle [October], and end [November] of the semester), pre-service teachers were provided a blank sheet of white paper and were given the prompt, *Draw an image depicting an effective teacher in agricultural education in the 21st Century*. Pre-service teachers were allowed roughly five minutes to respond to the prompt. Drawings were then collected and

analyzed by a team of three researchers to determine if and how students' perceptions changed throughout the semester.

Minogue (2010) stated that, "Drawings represent a relatively rich source of information. Drawings allow one to consider the setting, the arrangement of objects in physical space, and interactions in their depiction of a mental image" (p. 768-769). Analyzing drawings to deconstruct participants' mental models has a long history in educational research. The Draw-A-Man-Test was used in the 1920s (Goodenough, 1926). Since then, this original test has undergone various iterations to fit numerous disciplines. Most notably was the Draw-A-Science-Teacher-Test Checklist (DASTT-C) (Thomas et al., 2001). The DASTT-C was designed to measure perceptions of science students and teachers. After using the DASTT-C test to assess pre-service teachers in Turkey, Yilmaz, Turkmen, Pedersen, and Huyuguzel Cavas (2007) stated, "The DASTT-C is one of the essential instruments that can be used to help to develop techniques and procedures for promoting reflection and analysis of pre-service teachers' thinking" (p. 11).

Minogue (2010) utilized the DASTT-C version to quantify the data for the purpose of using inferential statistics and determining statistically significant differences in students' pre-course and post-course drawings. Minogue (2010) found that students changed their beliefs about teaching science by shifting from a teacher-centered approach to more of a student-centered approach.

Moseley, Desjean-Perrotta, and Utley (2010) developed the Draw-An-Environment Test Rubric (DAET-R) to determine how pre-service teachers in early childhood developed their mental images of the environment. However, no such test exists for agricultural education. Since agricultural education is "the world's oldest science" (Ricketts, Duncan, & Peake, 2006, p. 48), a modified version of the DASTT-C (Thomas et al., 2001) was employed for assessing pre-service teachers' beliefs in agricultural education.

There were 104 drawings total, including 22 complete data sets where three drawings were collected from the same student, and 22 incomplete data sets where fewer than three drawings

were collected from the same student. Incomplete data sets resulted from students being absent on the days in which the drawings were taken. All 104 original drawings were photocopied, and a set was provided to each of the three researchers for analysis.

Doolittle at al. (1993) stated that "capturing the essence of beliefs is . . . problematic because they are difficult to articulate, and the subtle, indirect evidence that establishes their presence must be gathered over long period of time to show stability or evolution" (p. 356). Therefore, data were analyzed in a series of iterations using the constant comparative analysis employed by Doolittle et al. (1993) in a similar study on teacher beliefs. The three researchers counted, named, interpreted, built consensus, and subjected their interpretations to statistical analysis to add rigor to the findings and conclusions (Creswell, 2007). Although visual data are interpretative, content analysis allows for quantifying images within a frame that can be subjected to statistical tests to measure effect size (Banks, 2007). The analysis protocol was designed to enhance validity, or the degree to which the findings are accurate representations of the participants' intentions (Creswell, 2012). The researchers' main concern in the analysis was to identify and measure accurately the change, or lack thereof, in teachers' conceptions of an effective secondary agricultural education instructor over time.

Analysis progressed through four phases. During the first phase, all three researchers followed a formalist approach where the drawings were subjected to "distinctive and patterned forms of analysis" of the content (Banks, 2007, p. 39), similar to a content analysis. The researchers used a positivist epistemology of literal identification of each distinct image in the drawing. Specifically, the researchers identified, named, and counted each component within all of the drawings and recorded them on a spreadsheet. Attention focused on components in the drawings such as the quantity, positions, actions, and emotions of teachers and students. For instance, Darling-Hammond and Baratz-Snowden (2007) stated,

> Despite the popular image of the teacher standing at the front of the room lecturing from a textbook and giving a quiz at

the end of the week, we now know that teachers whose students demonstrate strong achievement do much more. (p. 112)

Teachers should be active and engaging with their students and less teacher-centered (Darling-Hammon & Baratz-Snowden, 2007). Teacher-centered approaches assume that the teacher is *in charge* of the learning environment, is centered physically in the room facing students, and allows only a limited amount of input from the students (Thomas et al., 2001). In contrast, student-centered approaches assume that the teacher facilitates or guides activities by enabling students to manage their own learning, is in close proximity to the students but not necessarily in the center of the room, and allows students to discuss and debate concepts openly and freely (Thomas et al., 2001). Therefore, the positions in which teachers were depicted in the drawings were important because they had implications for whether the teacher was constructed as teacher-centered or student-centered. Researchers also analyzed all illustrations of classrooms and outdoor laboratories; symbols and words; animals and equipment related to their care; plants and trees; furniture and fixtures; vehicles, including trucks and tractors; and additional accouterments of the teaching and learning process in an agricultural and natural resources setting.

The second phase of the analysis was constructivist and interpretative (Creswell, 2012). Independently, the researchers used the quantity and names of the items in the drawings to construct four Gestalt themes of traditional versus emergent teaching, single versus multiple settings, limited versus diverse curriculum, and low versus high engagement. The themes were informed by the work of Thomas et al. (2001). Each image was rated from 0 (nonexistent) to 10 (completely saturated) on the degree to which each theme emerged from the data. The scores were also entered into a spreadsheet.

The third phase of the analysis was constructivist and consisted of confirming the interpretation of images to normalize and refine the Gestalt themes among the three researchers. In this phase, several face-to-face meetings were held for negotiations that continued until consensus was established among the research analysts. During these negotiation sessions, scores from the researchers' analysis were normalized for each image. The normalized scores were entered into the spreadsheet and subjected to quantitative analyses. Images were considered to represent changes in students' conceptions of an effective school-based agriculture teacher at three points in time and were measured by assessing differences in effect size using Cohen's *d* estimates (Banks, 2007).

In phase four, researchers used a positivist stance by interpreting the statistical effect size as an indication of the magnitude of change between the three data collection points. These combined steps allowed researchers to make assertions regarding pre-service teachers' conceptions of an effective agricultural education instructor over time.

Analyzing data on teacher beliefs is *messy* (Pajares, 1982); therefore, "researchers need agreement on the meaning and conceptualizations of belief" (Pajares, 1982, p. 326). To meet this need, inter-observer reliability was assumed. Inter-observer reliability is defined as the amount of congruence between observers' scores (Ary, Jacobs, & Razavieh, 2002). The researchers analyzed all 104 drawings individually by identifying and naming the images that he or she detected in the drawing, using the constructs identified by Thomas et al. (2001) as a guide. Then, throughout the data analysis process, researchers met to discuss their findings. Whenever discrepancies occurred in the scoring of drawings, the researchers reanalyzed the data jointly until consensus was reached. As such, no inter-rater reliability score was provided because the raters reached 100% agreement through this four-phase process.

Researcher bias is present in all social science research (Guba & Lincoln, 1989). However, researchers attempted to mitigate bias by open reflection on interpretations and negotiation using the team's strengths in different content areas. For example, two of the three researchers have deep experience in school-based agricultural education and understood the meaning of various images that was not clear to the third researcher, who in return challenged assumptions among the team. Ultimately, consensus was reached after listening to arguments supporting differing interpretations of images. Additional unavoidable bias rests with the dy-

namic of the data collection process. It is possible that students drew symbols and images that resonated with what had been taught previously in class. As such, students might have drawn images to please the instructor rather than to reflect their beliefs about teaching.

Findings

Analysis of the 104 drawing revealed four themes of effective teaching as constructed by pre-service teachers: Instruction, Settings, Curricular Diversity, and Engagement. A description of the elements present in the drawing that coalesced to form each theme is discussed in detail in the following section. Interpretation of the themes will be discussed in the following section.

Theme 1: Instruction

Instruction represented the classroom and laboratory context. Upon viewing the drawings, it was clear that the activity of the teacher and students was a theme that should be assessed. For instance, most all drawings had images of stick figures. It was often evident to the researchers who was intended to be the teacher and who was intended to be the student(s). The positioning and posture of the teacher and students were also apparent. For instance, in some drawings, the teacher was standing. In others, the teacher was sitting or bending down to assist with or demonstrate an action to students. At times the teacher was positioned at the head of the classroom, and at other times the teacher was in the midst of the students. Some drawings consisted of the teacher using an abundance of visual aids throughout the room. Some drawings consisted of students in an outdoor setting while others depicted a teacher standing in front of a classroom lecturing to students who were sitting in desks arranged in rows with no emotion or engagement. Engagement was illustrated by students with idea bubbles over their heads, hands raised, and arrows going back and forth between the teacher and the students. The drawings of teachers standing in front of a classroom lecturing to students as they sat in desks arranged in rows with no emotion or engagement, received lower scores. Conversely, drawings that showed teachers and students talking to

each other, with math or science symbols on a SMART Board®, and students with idea bubbles or raised hands received higher scores.

Theme 2: Setting

The type of setting was analyzed by the degree of contrast between the classroom and alternative environments. It was clear that in some drawings teachers and students were inside a classroom environment whereas in others, they were outside the classroom environment. It was also evident that some drawings included numerous settings whereas others only included one setting. For example, some pre-service teachers drew multiple settings in one scene to include a classroom, laboratory, school vehicle, and house. Others had only one setting, such as the classroom environment or laboratory. Images of classrooms, laboratories, outdoor scenes with trees or nature, settings depicting activity in or around barns, greenhouses, row crops, career development events, and/or people in vehicles were used to score the drawings. Drawings with only one setting were scored lower, whereas drawings with several settings were scored higher.

Theme 3: Curricular Diversity

The type of curriculum teachers depicted emerged as a key theme of the study. It was apparent that some drawings included only one content are, such as animal science, whereas other drawings included much more diverse content areas. Therefore, the theme *Curricular Diversity* was represented by images regarding the identification of various content areas in which teachers were exposing their students. In some cases, there was no evidence that any curriculum was being taught. An example was a teacher talking to students in a nondescript room. In other cases, no diversity was being offered in the curriculum by which students was learning. An example was a single image of a teaching demonstrating how to clip a steer. However, in some cases, examples of STEM were detected along with images on the wall of breeds of hogs. For example, if students were drawn preparing

an animal for exhibition only, the researchers interpreted the curriculum as animal science only and gave it a lower score. Likewise, if students were practicing for a CDE, as indicated by individuals assessing animals tied to a fence, it was assumed that the curriculum was associated with the Agricultural Science I course of this state's curriculum, and was viewed as lacking diversity. If, however, students and teachers were shown outdoors, surrounded by trees and nature, researchers interpreted that an environmental science curriculum was being depicted and rated those scenes higher. Likewise, if students and teachers were in a laboratory setting and students were interacting with science equipment, such as ring stands, beakers, and flasks, those scenes were rated with higher scores. Images containing a variety of activities or scenes also received higher scores.

Theme 4: Engagement

The fourth theme that emerged from the data dealt with the level of engagement of teachers and students. Engagement was represented by images of human interaction. In some drawings, students were receiving information passively while sitting in their desks facing the teacher. In others, students were actively involved with learning the content. Indicators of this action were students with their hands raised or idea bubbles over their heads. Engagement was also depicted regarding teachers' proximity to students, the number of idea bubbles or light bulbs depicted over students' heads, the number of students' whose hands were raised, the movement of teachers throughout the classroom, and amount and type of emotions drawn on students' faces. Drawings that contained images depicting teachers demonstrating, using visual aids, or do-

ing an activity with a student, in relationship to the students' actions, were rated with higher scores. Also, the position of the teacher was taken into account. For example, drawings received higher scores if the teacher was bending down to demonstrate a task to students or was shown walking through the classroom. In contrast, drawings received lower scores if teachers were shown as a static figure at the front of the classroom.

Generally, for all four themes, scores increased as the number and diversity of images included increased. For example, image 9B (see Figure 2) was scored 8 for instruction, 6 for settings, 5 for curricular diversity, and 2 for engagement. The rationale for these scores was based on the assessment that the drawing represented several teachers in various forms of instruction, each one doing different things in relation to the type of instruction used. In this drawing, the teacher is depicted demonstrating, lecturing, using visual aids, and doing an activity with a student. As such, the type of instruction was considered to be varied; thus, receiving a more elevated score on the continuum. The setting depicted contained images of students in a variety of locations including a laboratory, classroom, in groups, alone, and outside. Consequently, this image was rated in the middle of the continuum. Further, the drawing included an image of a CDE, a horse, indicators of STEM, such as a SMART Board®, science laboratory items, and gears, which represented an average amount of curricular diversity. Finally, although the teacher expressed happiness, with an idea bubble over her head, no idea bubbles were drawn over students' heads, nor were students' hands raised. Thus, due to the fact that students showed little participation, engagement was rated lower on the continuum.
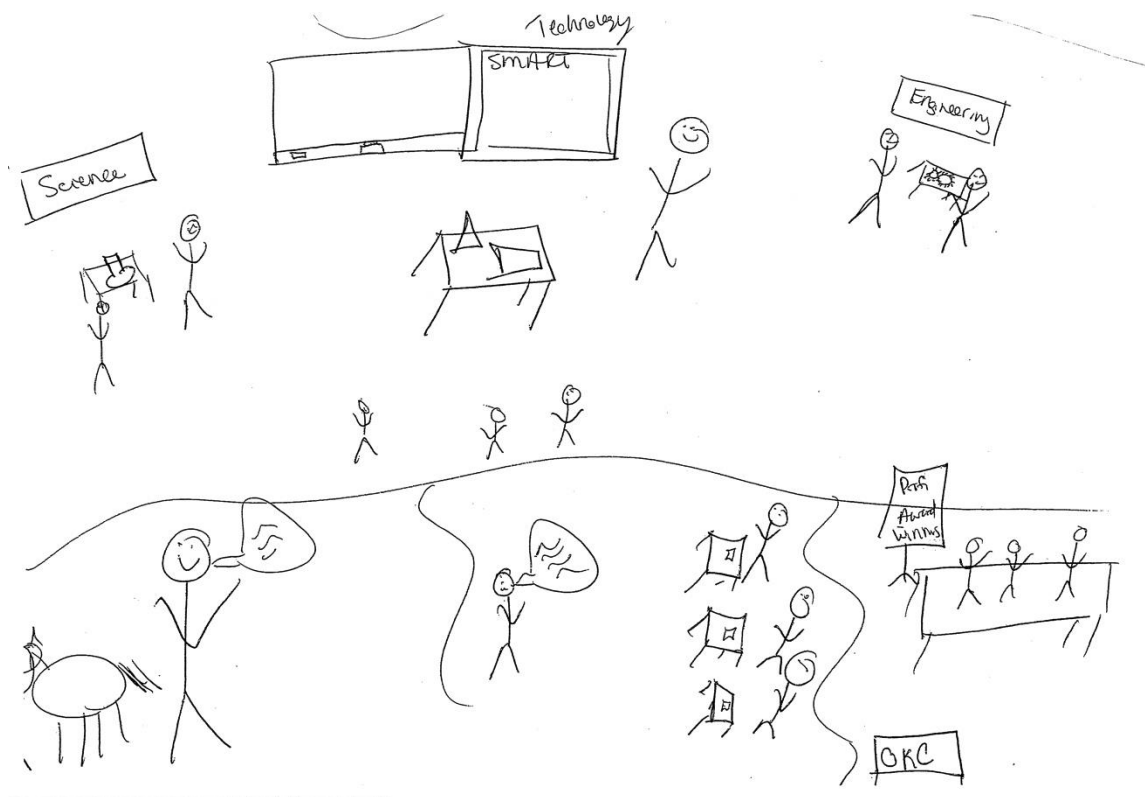
Figure 2. An example of a student's drawing of effective teaching in agricultural education at the middle of the semester.

The second research question analyzed how pre-service teachers' mental images of effective teaching changed throughout the semester. To address this question, researchers collected data images from pre-service teachers at three different times throughout the semester – beginning (August), middle (October), and end (November), according to an 11-point summated scale regarding how prevalent the constructs appeared in the drawings. The range of scores was 0 = non existent to 10 = completely saturated. Students' drawings exhibited limited depictions of instruction at the beginning of the semester ($M = 1.53$; $SD = 1.50$) (see Table 1). The number of images relating to instruction increased by almost two full points ($M = 3.26$; $SD = 2.57$) at the midpoint of the semester, only to taper off at the end of the semester ($M = 2.06$; $SD = 1.82$). The depiction of curricular diversity followed a simi-lar path. Students' drawings exhibited little curricular diversity at the beginning of the semester ($M = 1.79$; $SD = 1.83$). The detection of images relating to curricular diversity increased over one and one-half points at the midpoint of the semester ($M = 3.48$; $SD = 2.93$), only to decrease one point at the end of the semester ($M = 2.42$; $SD = 1.92$).

In contrast, scores for depictions related to the themes Settings and Engagement increased throughout the semester. For instance, images relating to settings increased by 1.33 points from beginning ($M = 2.42$; $SD = 1.97$) to the end ($M = 3.75$; $SD = 2.02$) of the semester. Similarly, images relating to engagement of students increased from by 1.23 points at the beginning ($M = 2.63$; $SD = 2.36$) to the end ($M = 3.86$; $SD = 2.42$) of the semester.

Table 1

The Changes of Pre-service Teachers' Mental Images throughout the Semester

Themes	Beginning		Middle		End	
	M	*SD*	*M*	*SD*	*M*	*SD*
Type of Instruction	1.53	1.50	3.26	2.57	2.06	1.82
Settings	2.42	1.97	3.63	2.24	3.75	2.02
Curricular Diversity	1.79	1.83	3.48	2.93	2.42	1.92
Engagement	2.63	2.36	3.70	2.95	3.86	2.42

Note. Scale = 0 = Non Existent to 10 = Completely Saturated

Because this study was interpretive in nature, the scale was used primarily as a means for normalizing the data between the three researchers to establish consensus. To that end, it was valuable for the researchers to determine a way to assess growth, or lack thereof, of the pre-service teachers' perceptions of effective teaching from beginning of the semester to the end. As such, effect sizes were calculated and interpreted according to Cohen's (1988) recommendations (i.e., small effect size [*d* = .20], medium effect size [*d* = .50], and large effect size [*d* = .80]).

A large, practical effect occurred from the beginning (August) to the middle (November) of the semester in the area of instruction (*d* = -.82) (see Table 2). Medium effects were detected in the amount of images drawn in the themes Settings (*d* = -.57) and Curricular Diversity (*d* = -.69) from the beginning to the middle of the semester. Few indications of growth were detected in students' drawings from the middle to the end of the semester in settings and engagement of students (*d* = -.06; -.06, respectively). However, large, practical effects occurred from the beginning to the end of the semester in the themes Settings (*d* = -.67) and Engagement of Students (*d* = -.51) (see Table 2).

Table 2

The Practical Significance of Pre-service Teachers' Changes in their Mental Images throughout the Semester, as Estimated by Cohen's d

Themes	Cohen's *d* Estimates		
	Beginning to Middle	Middle to End	Beginning to End
Type of Instruction	-.82	.54	-.32
Settings	-.57	-.06	-.67
Curricular Diversity	-.69	.43	-.34
Engagement of Students	-.40	-.06	-.51

Note. Cohen's *d* estimates ranged from .2 = small; .5 = medium; .8 = large

Conclusions

Based on the scoring of students' drawings, it can be concluded that pre-service teachers in agricultural education at Oklahoma State University enter the teacher preparation program with a limited understanding of, and appreciation for, the vastness of the roles of an effective agriculture teacher in the 21st Century. Using Minogue's (2010) theory of assessing mental images through drawings, students expressed few graphics that depicted any variety of instruc-

tion and curricular diversity at the beginning of the semester. In addition, students were conservative in drawing only a small variety of settings related to teaching agriculture and images that would be indicative of their appreciation for engaging students in the content of agriculture. At mid semester, however, students expanded their drawings to encompass additional indicators of instruction, settings, curriculum, and engagement. This conclusion indicates that students' constructed identity of effective teaching in an agricultural context can be modified.

Somewhat surprisingly, when factoring in the third and final set of drawings, conducted at the end of the semester, students digressed in the number and quality of indicators regarding instruction and curricular diversity. This finding is unsettling and deserves further examination as it is counter to findings of Minogue (2010), who reported that aspiring science teachers became more student-centered and less teacher-centered throughout their preparation. However, the finding appears to be in line with teacher beliefs theory that suggests that students enter teacher preparation programs with strong images and beliefs about what effective teaching looks like. They have been subjected, as recipients, to thousands of hours of instruction (Lortie, 1975) in which they were exposed to how teaching *really* occurs. As such, the pre-service teachers hold pre-conceived notions of teaching that are difficult to change (Feiman-Nemser, 2001; Doolittle et al., 1993). Unfortunately, change is slow to occur when the new information presented by teacher preparation faculty does not conform or is in direct violation with students' preconceived notions (Stipek, Givvin, Salmon, & MacGyners, 2001) and because, at times, preservice teachers think "they know more about teaching than they actually do" (Feiman-Nemser, 2001, p. 1016).

When factoring in practical effect, it is clear that the pre-service teachers participating in this study made significant adjustments in their ability to conceptualize the importance of instruction from the beginning to the middle of the semester. Although encouraging, we offer a possible explanation for this occurrence. When considering the lead instructor's course syllabus, a heavy emphasis on pedagogy in formal teaching was emphasized in the first half of the se-

mester. Further, there was much discussion about the integration of STEM principles in the context of agriculture. As such, it is possible that students drew images that related to most recent class discussions, and were perceived to be valued by the instructor, at the mid-semester. Likewise, there is a possible explanation for the digression of drawings from the midpoint to the end of the semester as well. Toward the end of the semester, several guest speakers frequent the course. Further, students conduct pre-service field experiences during the second one-half of the course. It is possible that students receive messages from agriculture teachers and guest speakers that differ from those presented by the instructor of the university course. Perhaps these factors led students to digress with their drawings from the middle to the end of the semester as it related to instruction – back to their original conceptions of effective teaching in an agriculture setting, which resulted in mental models that were well entrenched and difficult to unlock.

A positive result of this study is that the course had a positive impact on students' ability to conceptualize effective teaching, as indicated through their three drawings. As specified by the Cohen's *d* estimates, students' drawings ranged from a *small* to *medium* effect on the four themes, when comparing the drawings produced by students in the beginning of the semester to those at the end. It could be implied that the pre-service teachers accepted the practices that reflected best their own images of effective teaching.

Limitations to the Study

This study was limited by agency, or "the capacity of one person to act upon another, or to influence a set of social relations as a result of such action" (Banks, 2007, p. 11). Agency is a concern in that the course instructor asked the participants to draw their conceptions of an effective agricultural education instructor in the context of the course lessons at three points in time. It is difficult to discern if students were drawing images that truly reflected their authentic constructions or if they were seeking to please their instructor by drawing what they hoped was desired by the instructor regarding

effective teaching. In an attempt to offset this limitation, the lead instructor informed students that none of their drawings would be graded or assigned a score based on their quality or lack thereof. Yet, it is still possible that this biased students' drawings throughout the semester. The first set of images may be the most authentic of the trio as they were drawn at the start of the semester and demonstrate traditional notions of agricultural education settings, perhaps created from the students' memories of their experiences as participants in high school agriculture programs.

The format of the data could have been an additional limitation of the study. Only a simple prompt was given to the students: *Draw your idea of an effective agricultural education instructor*. The resulting images were not uniform. For example, some drawings had multiple figures and references to a variety of settings within the frame (Banks, 2007), while others have one figure and one setting. The researchers generally interpreted single figures with singular settings as traditional and exhibiting no change in conceptions, while drawings with multiple figures and settings were interpreted as being emergent in nature, having changed over time. Perhaps if the prompt had been more specific, for example, "Draw one figure in one setting," then the strength of interpretation and transferability would have been stronger.

Another limitation to interpreting the drawings was representation, or "the thing seen – the representation – is a thing in its own right, not merely a substitute for the thing unseen, the thing represented" (Banks, 2007, p. 15). Students were given a short time to draw their representation of an effective agricultural education instructor, and may have been limited by their ability to express themselves in this format, thus, not representing their conceptions fully. Follow-up interviews with the students using their drawings as a basis for the conversation would have allowed for more clarity regarding students' conceptions as represented in the drawings.

Finally, the methods used to analyze the data could be viewed as a limitation to the study. Because no instrument existed in agricultural education, the authors chose to use a constant comparative analysis, as used in a similar study that assessed teacher beliefs (Doolittle et al.,

1993). The results of this study will allow for a more robust instrument to be developed in used in future studies that assess teacher beliefs.

Recommendations for Practice

To see long-lasting changes in perceptions, Korthagen and Kessels (1999) recommended that teacher educators begin at the Gestalt level by adding more experiences for which aspiring teachers can form schemata. Feiman-Nemser (2001) stated that,

> Unless teacher educators engage prospective teachers in a critical examination of their entering beliefs in light of compelling alternatives and help them develop powerful images of good teaching and strong professional commitments, these entering beliefs will continue to shape their ideas and practices. (p. 1017)

Therefore, instructors should consider adding a wider variety of early field-based experiences for future pre-service teachers that challenge their beliefs about teaching. For instance, pre-service teachers should be assessed on their teacher beliefs early in their tenure as undergraduate students. Once their beliefs have been identified, instructors should work to provide cognitive dissonance by encouraging students to participate in experiences that challenge their beliefs directly (Calderhead & Robson, 1991; Kagan, 1992; Pajares, 1992) so that they can begin to imagine what agricultural education could be as opposed to what it is. In fact, Kagan (1992) stated, "cognitive dissonance may be necessary for novices to confront their own beliefs and images and acknowledge that they need adjustment" (p. 163). For instance, perhaps students who believe agricultural education is about providing FFA experiences and training Career Development Event (CDE) teams, should be required to observe a program that focuses on helping students secure jobs within the community as part of their placement Supervised Agricultural Experience (SAE). Since changes in teachers' beliefs can be a slow, arduous process, providing an array of diverse experiences should be the goal of all teacher preparation programs. Only then will students be able to compare certain ideas against their own beliefs, thus, allow-

ing them opportunities to determine which changes, if any, they will make.

Recommendations for Future Research

With numerous types of self-reporting analysis, people tend to overestimate their ability to perform tasks regarding how they teach (Woolfolk Hoy & Spero, 2005) as well as what they think they can teach (Scales, Terry, & Torres, 2009). As such, it is possible that the pre-service teachers drew images that they believed they could perform and not images that they believed were truly characteristics of effective teachers. Since each pre-service teacher is required to teach three microlessons that are videotaped, further studies should compare the teachers' drawings to their actual performance while teaching to determine if they are being effective according to their own criteria. In other words, is there a relationship between pre-service teachers' pedagogical beliefs and their performance in the classroom (Ertmer, 2005)? These findings would provide rich data, potentially, for aspiring teachers who have a desire to improve their trade.

To detect changes in philosophy, prolonged and sustained interventions are needed so that schemas can be tied to theory (Feiman-Nemser, 2001; Korthagen & Kessels, 1999). Therefore, students should be assessed throughout their educational careers at Oklahoma State University to determine the effect that the entire teacher preparation program has on their mental imagery processes. For example, how do students' mental models change from their freshman year to their senior year? Likewise, what impact does the student teaching experience have on teachers' mental images? Future research should explore these phenomena because students' *world images* have implications for how they will teach. Thus, it is teacher educators' responsibility to help transfer their world images into effective teaching habits and traits (Wubbles, 1992).

Finally, can students truly be transformed in their way of thinking about effective teaching during their teacher preparation in higher education? If so, do they sustain this transformed way of thinking, or do they conform once they exit their teacher preparation program and enter the teaching ranks? Future research should be conducted, longitudinally, to track these pre-service teachers into their first few years in the profession. These findings would have implications for the types of teacher professional development offered and the frequency in which they occurred.

References

Akiba, M., LeTenre, G. K., & Scribner, J. P. (2007). Teacher quality, gap, and national achievement in 46 countries. *Educational Researcher, 36*, 369–387. doi: 10.3102/0013189X07308739

Ary, D., Jacobs, L. C., & Razavieh, A. (2002). *Introduction to Research in Education* (6th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Bandura, A. (1994). Self-Efficacy. In V.S. Ramachaudran (Ed.), *Encyclopedia of Human Behavior, 4*, 71–81.

Banks, M. (2007). *Using visual data in qualitative research*. Thousand Oaks, CA: Sage.

Byrne, R. M. J. (2002). Mental models and counterfactual thoughts about what might have been. *Trends in Cognitive Sciences, 6*(10), 426–431.

Calderhead, J., & Robson, M. (1991). Images of teaching: Student teachers' early conceptions of classroom practice. *Teaching and Teacher Education, 7*(1), 1–8.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches.* Thousand Oaks, CA: Sage.

Creswell, J. (2012). *Qualitative inquiry and research design: Choosing among five approaches*. Los Angeles, CA: Sage Publication, Inc.

Darling-Hammond, L., & Baratz-Snowden, J. (2007). A good teacher in every classroom: Preparing the highly qualified teachers our children deserve. *Educational Horizons*, 111–132.

Doolittle, S. A., Dodds, P., & Placek, J. H. (1993). Persistence of beliefs about teaching during formal training of preservice teachers. *Journal of Teaching in Physical Education, 12*(4), 355–365. Retrieved from http://journals.humankinetics.com/AcuCustom/SiteName/Documents/DocumentItem/10231.pdf

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25–39. doi: 10.1007/BF02504683

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record, 103*(6), 1013–1055.

Feistritzer, C. E., & Haar, C. K. (2008). *Alternative routes to teaching*. Upper Saddle River, NJ: Pearson.

Good, T. L., McCaslin, M., Tsang, H. Y., Zhang, J., Wiley, C. R. H., Bozack, A. R., & Hester, W. (2006). How well do 1st –year teachers teach: Does type of preparation make a difference? *Journal of Teacher Education, 57*(4), 410–430. doi: 10.1177/0022487106291566

Goodenough, F. (1926). Measurement of intelligence by drawings. New York, NY: Harcourt Brace.

Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park, CA: Sage Publications.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*(1), 88–140.

Jenkins, C. C. III, & Kitchel, T. (2010). Defining agricultural education instructional quality indicators. *Journal of Agricultural Education, 51*(3), 53–63. doi: 10.5032/jae.2010.03053

Johnson-Laird, P. N. (2001). Mental models and deduction. *Trends in Cognitive Sciences, 15*(10), 434–442.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. *Review of Educational Research, 62*(2), 129–169. doi: 10.3102/00346543062002129

Korthagen, F. A. J., & Kessels, J. P. A. M. (1999). Linking theory to practice: Changing the pedagogy of teacher education. *Educational Researcher, 28*(4), 4–17.

Lortie, D. (1975). *Schoolteacher*. Chicago, IL: University of Chicago Press.

Martin, N. (2008). Assessing portrait drawings created by children and adolescents with autism spectrum disorder. *Art Therapy: Journal of the American Art Therapy Association, 25*(1), 15–23.

Minogue, J. (2010). What is the teacher doing? What are the students doing? An application of the draw-a-science-teacher-test. *Journal of Science Teacher Education, 21*, 767–781. doi: 10.1007/s10972-009-9170-7

Moseley, C., Desjean-Perrotta, B., & Utley, J. (2010). The draw-an-environment test rubric (DAET-R): Exploring pre-service teachers' mental models of the environment. *Environmental Education Research, 16*(2), 189–208. doi: 10.1080/13504620903548674

Pajares, M. F. (1982). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307–332. doi: 10.3102/00346543062003307

Ricketts, J. C., Duncan, D. D., & Peake, J. B. (2006). Science achievement of high school students in complete programs of agriscience education. *Journal of Agricultural Education, 47*(2), 48–55. doi: 10.5032/jae.2006.02048

Roberts, T. G., & Dyer, J. E. (2004). Characteristics of effective agriculture teachers. *Journal of Agricultural Education, 45*(4), 82–95. doi: 10.5032/jae.2004.04082

Santrock, J. W. (2004). *Educational psychology* (2nd ed.). Boston, MA: McGraw-Hill Companies, Inc.

Scales, J., Terry, Jr. R., & Torres, R. M. (2009). Are teachers ready to integrate science concepts into secondary agriculture programs? *Journal of Agricultural Education, 50*(2), 100–111. doi: 10.1016/S0742-051X(00)00052-4

Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education, 17*(2), 213 – 226. doi: 10.1016/S0742-051

Thomas, J., Pederson, J., & Finson, K. (2001). Validating the Draw-A-Science-Teacher-Test checklist (DASTT-C): Exploring mental models and teacher beliefs. *Journal of Science Teacher Education, 12*(4), 295–310. doi: 10.1023/A:1014216328867

Wideen, M., Mayer-Smith, J., & Moon, B. (1998). A critical analysis on learning to teach: Making the case for an ecological perspective on inquiry. *Review of Educational Research, 68*(2), 130–178.

Woolfolk Hoy, A., & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education, 21*(4), 343–356. doi: 10.1016/j.tate.2005.01.007

Wubbles, T. (1992). Taking account of student teachers' preconceptions. *Teaching and Teacher Education, 8*(2), 137–149. doi: 10.1016/0742-051X(92)90004-M

Yilmaz, H., Turkmen, H., Pedersen, J. E., & Huyuguzel Cavas, P. (2007). Evaluation of pre-service teachers' images of science teaching in Turkey. *Asia-Pacific Forum on Science Learning and Teaching, 8*(1), 1–14.

J. SHANE ROBINSON is an Associate Professor in the Department of Agricultural Education, Communications and Leadership and the Associate Director of the Institute for Teaching and Learning Excellence at Oklahoma State University, 100 ITLE, Stillwater, OK 74078, shane.robinson@okstate.edu

KATHLEEN D. KELSEY is a Professor and Head of the Department of Agricultural Leadership, Education and Communication at the University of Georgia, 142 Four Towers, Athens, GA 30602-4355, kdk@uga.edu

ROBERT TERRY, Jr. is a Professor and Head of the Department of Agricultural Education, Communications and Leadership at Oklahoma State University, 449 Agriculture Hall, Stillwater, OK 74078-6031, rob.terry@okstate.edu